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**REPORT B80763**

**DESIGN EVALUATION  
ADJUSTABLE ENGINE MOUNT  
BELL 204B, 205A-1 & 205B**

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PREPARED T Martin	 <b>AERO CONSULTING SERVICES LTD.</b>	REPORT NO. <b>B80763</b>
DATE 12 Feb 98		PAGE NO. 1.01

**1.0 INTRODUCTION**

**1.1 PURPOSE**

To demonstrate, by reference to the design, how compliance with FAR 29, 01 January, 1984 is achieved for the installation of an adjustable engine mount in the Bell 204B, Bell 205A-1 and Bell 205B Helicopters.

**1.2 SCOPE**

This substantiation report examines those airworthiness standards in Compliance Check List B80765 for which "Evaluation" is listed as the method of compliance and describes how compliance is achieved. Specifically, Section 2 of this report breaks down FAR 29 into applicable subparts and airworthiness standards, for each of which a substantiating response is given.

**1.3 GENERAL DESCRIPTION**

Operational criteria for the Bell 204B, 205A-1 and 205B necessitates alignment of the engine and transmission within a specified tolerance. The standard practice to achieve alignment uses shims placed under each engine mount pad. Whenever the engine or transmission is disturbed, adjustment of the shimming stacks is necessary to regain alignment.

In order to simplify and speed up the alignment procedure, each tube in the engine mount installation is made adjustable by the incorporation of turnbuckle type assembly. When alignment is achieved, each turnbuckle body is locked in position with jam nuts. The jam nuts are lock wired to prevent them backing off in service.

The existing engine mount installation consists of a tripod tube assembly, a bipod tube assembly and a single tube assembly. In this modification, all six of these tubes are reworked to incorporate a turnbuckle type assembly. Incorporation of the turnbuckle requires each tube to be cut at a specified point. The portion of tube below each cut-off point, including a self-aligning bearing, is discarded and replaced with the turnbuckle and a new bearing. Installation of the turnbuckle restores each tube to its original length and provides a means of adjustment when aligning engine and helicopter transmission.

PREPARED T Martin	 <b>AERO CONSULTING SERVICES LTD.</b>	REPORT NO. <b>B80763</b>
DATE 12 Feb 98		PAGE NO. 2.01

## 2.0 SUBSTANTIATION

By reference to the engineering drawings listed on MDS B80700, substantiation of compliance with each of the following airworthiness standards is demonstrated below.

### 2.1 SUBPART D, DESIGN and CONSTRUCTION

*29.601 Design. The rotorcraft may have no design features or details that experience has shown to be hazardous or unreliable.*

No hazardous design features are introduced by the Adjustable Engine Mount. All materials and fabrication processes are of a type with known and reliable mechanical properties. (Ref. Dwg. B80701 through B80705.)

*29.603 Materials. Suitability and durability of materials.....meet approved specifications.....take the effects of environment into account.*

Materials used are appropriate to the operating conditions which they will experience, in terms of temperature, corrosion and abrasion. Materials used in manufactured components are produced to controlling specifications which ensures their properties are as assumed in ACS structural substantiation report B80710. (Ref. Dwg. B80702 through B80705.)

*29.605 Fabrication methods. Close control of processes such as gluing, spot welding, heat treatment and any new process is required.*

No methods of fabrication in this category are used.

*29.607 Fasteners. (a) Each removable bolt, screw, nut, pin, or other fastener whose loss could jeopardize the safe operation of the rotorcraft must incorporate two separate locking devices. The fastener or the locking device may not be adversely affected by the environmental conditions associated with the particular installation.*

The turnbuckle assembly is locked in position with two jam nuts. Each jam nut is safety wired to prevent loosening in service. The safety wire is stainless steel, a material that is not adversely affected by environmental conditions in the engine fire zone. (Ref. Dwg. B80701, Installation.)

*29.609 Protection of structure. Each part of the structure must be suitably protected against deterioration or loss of strength in service due to any cause.*

Manufactured parts are cadmium plated to protect them from deterioration due to corrosion. Cadmium is a material that is commonly accepted as being effective for corrosion control when used on aircraft and aircraft equipment. Additionally, threaded portions of the turnbuckle are protected using a solvent dispersed corrosion preventive compound. The interior of the turnbuckle body is protected against ingress of moisture by sealing all openings with rubberized sealant. Purchased parts

REVISED 01 MAY 01

PREPARED T Martin	 <b>AERO CONSULTING SERVICES LTD.</b>	REPORT NO. <b>B80763</b>
DATE 12 Feb 98		PAGE NO. 2.02

## 2.2 SUBPART D, DESIGN and CONSTRUCTION (Continued)

are either manufactured from corrosion resistant steel or are protected using a finish commonly accepted as being effective for corrosion control when used on aircraft and aircraft equipment. (Ref. Dwgs. B80701 through B80705.)

*29.611 Inspection provisions. There must be means to allow the close examination of each part that requires recurring inspection, adjustment or lubrication.*

Each turnbuckle can be closely inspected by removal of the engine cowlings. No other features exist that block inspection, once the cowlings are removed. Inspection holes are provided in the turnbuckle body to allow verification that thread engagement is at or above the minimum required. (Ref. Dwg. B80701, Installation.)

*29.619 Special factors. Uncertain strength.....variability in manufacturing, processing or inspection methods.*

All components and materials used in the Adjustable Engine Mount are of known strength or are made from materials of known strength. Manufacturing, processing and inspection methods are those which experience has shown to be reliable.

*29.621 Casting factors.*

No castings are installed by the dual seat modification.

*29.623 Bearing factors. Each part that has clearance, and that is subject to pounding or vibration, must have a bearing factor large enough to provide for the effects of normal relative motion.*

No part of the Adjustable Engine Mount contains loaded bearing parts with clearance enough to vibrate or pound in service.

*29.625 Fitting factors. For each fitting (part or terminal used to join one structural member to another) the following apply: (b) No fitting factor need be used - (1) For joints made under approved practices and based on comprehensive test data (such as continuous joints in metal plating, welded joints, and scarf joints in wood).*


The Adjustable Engine Mount contains turnbuckles that are attached to self-aligning bearings at one end and existing tubular steel engine mount structure at the other. No fitting factor need be used, as both ends are attached by means of solid stainless steel rivets installed in a configuration that is identical to that used and approved by the OEM. (Ref. Dwg. B80701, Installation.)

*29.861 Fire protection of structure, controls, and other parts. Each part of the structure, controls, and the rotor mechanism, and other parts essential to controlled landing and (for category A) flight that would be affected by powerplant fires must be isolated under Sec. 29.1191, or must be -*

*(a) For category A rotorcraft, fireproof; and*

*(b) For category B rotorcraft, protected so that they can perform their essential functions for at least five minutes under any foreseeable powerplant fire condition.*

REVISED 01 MAY 01

PREPARED T Martin	 <b>AERO CONSULTING SERVICES LTD.</b>	REPORT NO. <b>B80763</b>
DATE 12 Feb 98		PAGE NO. 2.03
<p>Manufactured components and purchased parts are made from steel or stainless steel with sufficient thickness to be fireproof by definition per FAR 23.1191(h)(1).</p>		